PHILIPS

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Electronic VAΩ meter

PM 2503

9449 025 03..1

9499 475 00611

761001

PHILIPS

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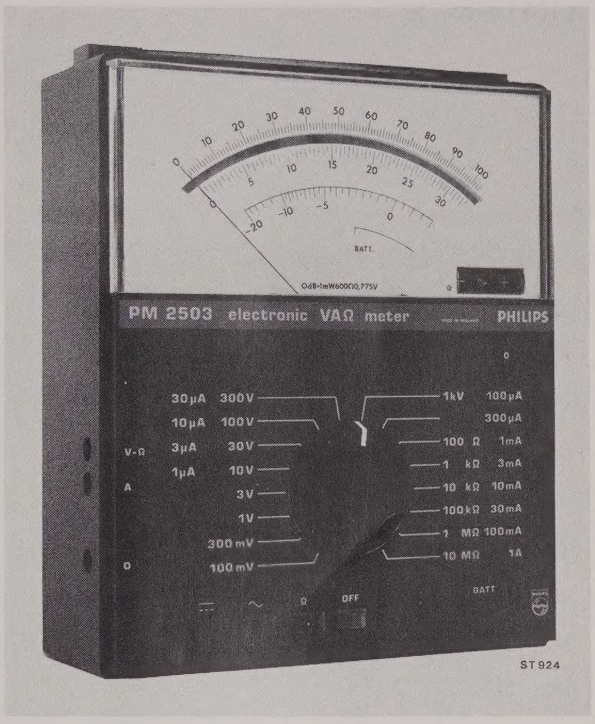

Service Manual

Electronic VAΩ meter

PM2503

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IMPORTANT

In correspondence concerning this instrument please quote the type- and the serial number as given on the type plate at the rear of the instrument.

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I. Introduction GENERAL

The electronic multimeter PM 2503 is an universal measuring instrument with 48 measuring ranges, a completely integrated amplifier with FET input, a linear ohm-scale and a combined input socket V-Ω.
The instrument is very easy to control for various reasons, viz: mono-knob for range selection, three push-buttons for functions ⎓ ; ∿ ; Ω ; switching on the instrument, a knob OFF and one knob for checking both batteries.

The high input impedance enables to perform precise measurements on circuits with high source impedance.

The instrument is supplied from two 9 V - batteries.

The properties mentioned, together with the easily readible mirror scale and the automatic polarity indication gives a wide application field in labs, TV and radio service stations, educational purposes and industry.

II. Technical data

Properties expressed in numerical values with tolerances stated are guaranteed.
Values without statement of tolerances indicate the properties of an average instrument and merely serve for information.

II-1. MEASURING RANGES

II-1.1. D.c. and a.c. voltages

Measuring range	5 mV ... 1000 V 9 ranges: 100 mV; 300 mV; 1 V; 3 V; 10 V; 30 V; 100 V; 300 V and 1000 V (full scale values)		
Sensitivity	5 mV		
Accuracy (f.s.d.)	100 mV ... 1000 V ⎓		± 2%
	100 mV ... 300 V ∿	10 Hz - 30 kHz	± 3%
		30 kHz - 50 kHz	± 5%
		10 Hz - 100 Hz	± 3%
		100 Hz - 10 kHz	± 10%

Input impedance	100 mV 20 MΩ//30 pF 300 mV 12 MΩ//45 pF 1 V 10.5 MΩ//52 pF 3 V ... 1000 V 10 MΩ//55 pF
Overload	2000 V max. (all ranges)

II-1.2. D.c. and a.c. currents

Measuring range	50 nA ... 1 A 12 ranges: 1 µA; 3 µA; 10 µA; 30 µA; 100 µA; 300 µA; 1 mA; 3 mA; 10 mA; 30 mA; 100 mA and 1 A
Sensitivity	50 nA
Accuracy	1 µA ... 1 A ⎓ ±2% 1 µA ... 1 A ∼ ±3%
Voltage drop	1 µA ... 100 mA ≤100 mV 1 A ≤250 mV
Frequency range	1 µA ... 100 µA 10 Hz - 70 Hz 300 µA ... 30 mA 10 Hz - 30 kHz 100 mA ... 1 A 10 Hz - 2 kHz
Protection	Fuse 2 A

II-1.3. Resistance values

Measuring range	5 Ω ... 10 MΩ 6 ranges: 100 Ω; 1 kΩ; 10 kΩ; 100 kΩ; 1 MΩ and 10 MΩ
Sensitivity	5 Ω
Accuracy	+3% (f.s.d.)
Measuring voltage (f.s.d.)	50 mV in ranges 100 Ω; 10 kΩ and 1 MΩ 500 mV in ranges 1 kΩ; 100 kΩ and 10 MΩ } version -/01 100 mV in ranges 100 Ω; 10 kΩ and 1 MΩ 1 V in ranges 1 kΩ; 100 kΩ and 10 MΩ } version -/02 and -/03
Read-out	Linear
Protection	Fuse 125 mA Max. permissible voltage 220 V

II-2. GENERAL DATA

Temperature range	0 - 55°C
Meter system	Tautband suspension 50 µA Polarity indicator [- ∼ +]
Supply	+ and - 9 V Possible battery checking
Batteries	2 x 9 V (e.g. Philips 6 F 22 TR)
Life time	1000 hours
Dimensions	185 x 150 x 80 mm
Weight	approx. 800 gr.

III. Accessories

III-1. UPON DELIVERY

- Measuring cable PM 9260
- 2 Fuses of 2 A
- 2 Fuses of 125 mA
- Directions for use

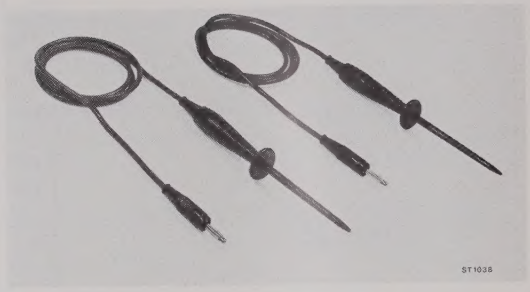


Fig. 1. Measuring cable PM 9260

III-2. OPTIONAL

III-2.1. x 2 attenuator PM 9262

Input resistance 10 MΩ

Max. power 1 W

Max. operating voltage 1700 V

III-2.2. Shunt PM 9244

Measuring range	10 A and 31.6 A (max. 1 kHz)
Output voltage	100 mV
Accuracy	±1%
Power consumption	max. 3.16 W
Dimensions	Height 55 mm Length 140 mm Width 65 mm

Fig. 2. Shunt PM 9244

III-2.3. Current transformer PM 9245

Measuring range	10 A ... 100 A
Transformer ratio	1000 x (100 A = 100 mA)
Accuracy	±3%
Frequency range	45 Hz ... 1 kHz
Secundary voltage drop	<200 mV
Max. voltage to earth	400 V
Maximum air gap	0.05 mm

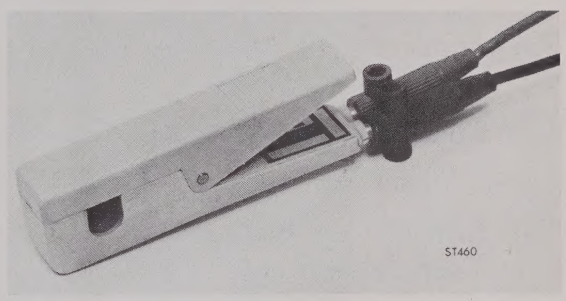


Fig. 3. Current transformer PM 9245

III-2.4. H.T. Measuring probe PM 9246

Maximum voltage	30 kV
Attenuation	1000 x
Input impedance	600 MΩ ±5%
Accuracy	±3%

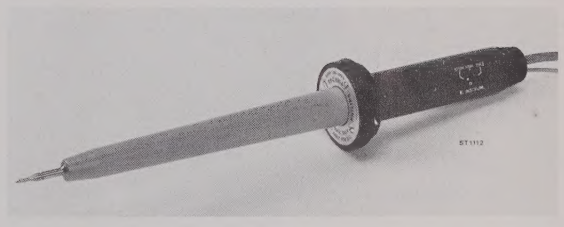


Fig. 4. HT probe PM 9246

III-2.5. Everready case PM 9273

IV. Preparations

DIRECTIONS FOR USE

IV-1. POWER SUPPLY

For the power supply of the instrument, two 9 V-batteries are used which are accomodated in the battery compartment. Recommended type: 6 F 22 TR.
The battery compartment is accessible after removing the battery cover at the rear by means of a screwdriver (see Fig. 6, page 9).

IV-2. ZERO SETTING (Fig. 5, page 9)

- Adjust the pointer to 0 by means of correction screw above mono-knob (instrument switched off)
- Depress knob "⎓"
- Adjust polarity indicator in the middle of the a.c. voltage sign with potentiometer "0" [− ∿ +]

IV-3. BATTERY CHECK (Fig. 5, page 9)

- Depress button "BATT"
- The meter indication must be in the BATT region (lower scale). The upper scale indicates the average battery voltage in volts. A voltage difference ≥ 3 V between both batteries indicates also that the batteries are empty.
- If necessary, replace the batteries

IV-4. CALIBRATION (Fig. 7, page 9)

- Remove the battery cover
- Connect BU4 to input "V-Ω"
- Set mono-knob to 1 V
- Depress button "⎓"
- Adjust the meter deviation to 100 scale divisions by means of potentiometer "CAL"

Note: Calibration is only necessary in case of replacing the batteries.

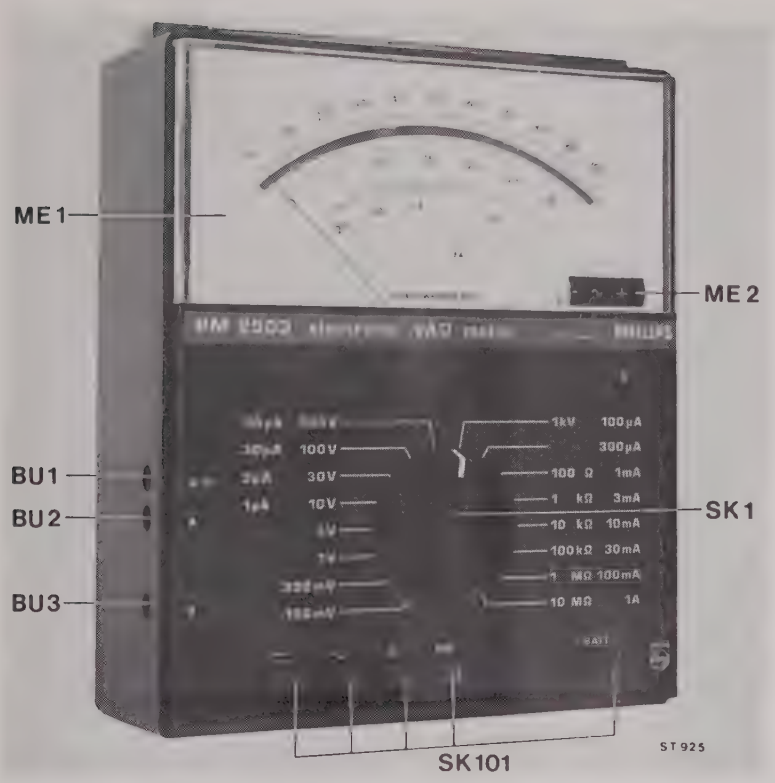


Fig. 5. Front view

Fig. 6. Removing the battery cover

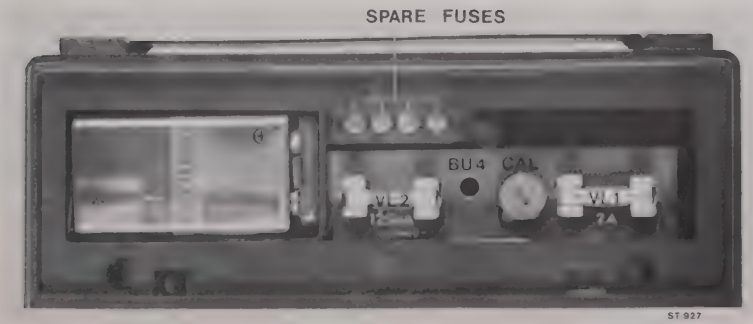


Fig. 7. Calibrating the PM 2503

V. Measuring

V-1. D.C. AND A.C. VOLTAGES

- Depress button "⎓" or "∿"
- Set mono-knob to the highest range
- Connect the measuring voltage to sockets "V-Ω" and "0"
- Select the correct measuring range by means of the mono-knob
- For the polarity of d.c. voltages (socket "V-Ω" with respect to "0"), see indicator

Note: 1. D.c. voltages over 1 kV up to 30 kV can be measured with a H.T. measuring probe PM 9246.
Select an impedance of 10 MΩ on the probe.

2. D.c. voltages with H.T. interference can be measured by means of x 2 attenuator PM 9262.

V-2. D.C AND A.C. CURRENTS

- Depress button "⎓" or "∿"
- Set the mono-knob to the highest range
- Connect the current to be measured to sockets "A" and "0"
- Select the correct measuring range by means of the mono-knob
- For the polarity of d.c. currents (socket "A" with respect to "0"), see indicator

Note: 1. A.c. currents over 1 A up to 100 A can be measured with current transformer PM 9245

2. D.c. currents up to 10 A or 31.6 A can be measured with shunt PM 9244.

V-3. RESISTANCE VALUES

- Depress button "Ω"
- Connect the resistor to be measured to sockets "V-Ω" and "0"
- Select the correct measuring range by means of the mono-knob

Note: Do not forget that measuring resistance should be performed without voltage!

V-4. DIODE MEASUREMENTS

- Depress button "Ω"
- Select the 100 kΩ range
- Connect the diode to the "V-Ω" and the "0" socket according the table below:

	V-Ω / 0	V-Ω / 0
Ge	10 - 30	> 100
Si	60 - 90	> 100

Note: In the -/02 version and following the diodes must be measured in the 1 kΩ range.

V-5. PROTECTION

The circuit is protected against a voltage overload up to 2 kV. The current ranges are protected with a fuse of 2 A. The resistance ranges are protected with a fuse of 125 mA.
These fuses are accessible by removing the cover of the battery compartment.
Behind this cover 2 spare fuses of each value are available.

V-6. SWITCHING OFF

The instrument is switched off by depressing the red push-button "OFF".
In this way, all other push-buttons are set to rest position.

VI. Circuit description

SERVICE DATA

VI-1. GENERAL

The circuitry of the PM 2503 is built up of a complete integrated amplifier part, preceded by attenuators for the various voltage, current and resistance ranges. The integrated amplifier part consists of an operational amplifier (IC/A) together with the rectifier diodes for the measuring system, a reference amplifier (IC/B) for the resistance ranges and two protection diodes (IC/C).
The high input impedance of the PM 2503 is obtained by a FET-input stage.
The high sensitivity of the moving coil system has been achieved by tautbandsuspension.
If sinusoidal voltages or currents are applied, the moving coil instrument measures $\frac{1}{2}\sqrt{2} \times V$ (= Vrms) of the signal with the aid of the full wave rectifier (IC/A) and the formfactor network R145, R157, C126, R146 and C110 (Fig. 18, page 26 - 30 - 34).

VI-2. D.C. AND A.C. VOLTAGE MEASUREMENTS

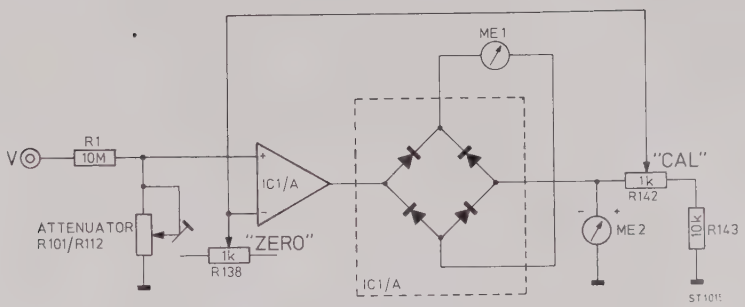


Fig. 8. d.c. and a.c. voltage measurements

The d.c.-input voltage is supplied to the input of the differential stage (TS103) via a voltage divider. The voltage divider consists of resistor R1 and the attenuator resistors R101 up to R112. At full scale deflection the attenuated input voltage is $\approx$ 50 mV.
Through the measuring system ME1 then flows 50 µA. In the differential stage the output voltage of the amplifier is compared with the input voltage. The total gain of the amplifier is 1.

By means of resistor "CAL" the gain of the amplifier may be adjusted.

- At d.c. voltage measurements the filter R133/C112/C116 connects the a.c. components to zero.
- At a.c. voltage measurements the output of the amplifier is fed back to the input of the differential stage via the formfactornetwork R145, C110 and R146.
  The measuring instrument measures $\frac{1}{2}\sqrt{2} \times V$ (= Vrms) (see sub. 1).
  Capacitor C114 uncouples the a.c. signal.

VI-3. D.C. AND A.C. CURRENT MEASUREMENTS

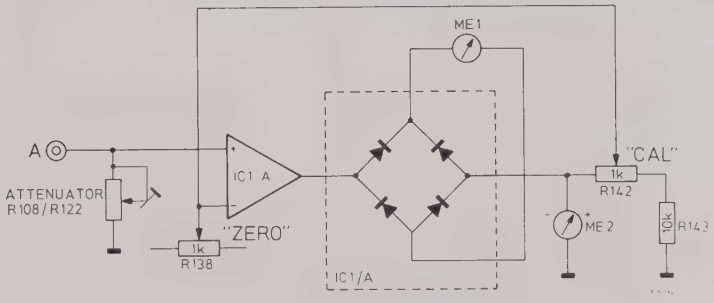


Fig. 9. d.c. and a.c. current measurements

By means of the shunts R108 up to R122 the current is measured. The voltage drop over the shunt at full scale deflection is 50 mV, which is supplied to the input of the differential stage (TS103) and is measured in the same way as the d.c. and a.c. voltages.

VI-4. RESISTANCE MEASUREMENTS

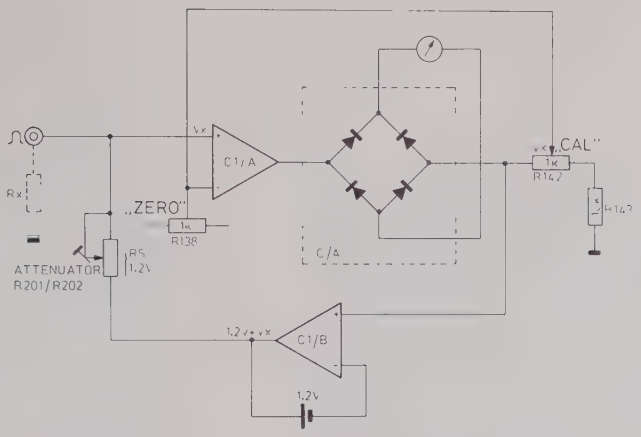


Fig. 10. Resistance measurements

When an unknown resistance Rx is connected to the input of PM 2503, a constant current will flow through it. The constant current causes a voltage drop Vx across resistance Rx, which is supplied to the input of the differential stage of amplifier IC1/A. The constant current causing the voltage drop across Rx is generated by reference amplifier IC1/B.
At the input of the differential stage of amplifier IC1/A, Vx is available. As the gain of this amplifier is 1, the output voltage will be equal to the input voltage.
Vx will be available on the input of reference amplifier IC1/B. The reference amplifier has an internal voltage source of 1.2 V. By this it's output will become 1.2 V + Vx.
As the input voltage of the amplifier is Vx, the voltage across attenuator resistor R5 is 1.2 V. Independent to the value of Rx (Vx), there always will be a voltage of 1.2 V across attenuator resistor Rs and a constant current will flow through the unknown resistance Rx.
In the ranges 100 Ω, 10 kΩ and 1 MΩ the measuring voltage Vx is 50 mV at full scale deflection.
In the ranges 1 kΩ, 100 kΩ and 10 MΩ the measuring voltage Vx is 500 mV at full scale deflection.
The gain of amplifier IC1/A then is 1/10. This is achieved by connecting resistors R140 and R141 in parallel to the feedback resistor R142 and R143.
In the -/02 and -/03 version of the PM 2503 the measuring voltages Vx at full scale deflection are increased up to 100 mV for the ranges 100 Ω, 10 kΩ and 1 MΩ and up to 1 V for the ranges 1 kΩ, 100 kΩ and 10 MΩ.

VI-5. DIODE MEASUREMENTS

In the -/01 version of the PM 2503, diodes are measured in the 100 kΩ range.
The measuring voltage is 500 mV.
In the -/02 version and following, diodes are measured in the 1 kΩ range.
The measuring voltage is 1 V.
To increase the measuring voltage from 500 mV to 1 V for the -/02 version and following, the resistors R125, R201 and R202 are adapted.

VII. Access

VII-1. REMOVING THE HOUSING

- Remove the battery cover (see Fig. 12, page 16)
- Remove the two screw 1 (Fig. 15, page 16) which are situated under the battery cover
- Lift the chassis out of the housing

VII-2. REMOVING THE TEXTPLATE

- Remove the housing (see sub. 1)
- Bend out the four lips of the textplate
- Lift the textplate of the chassis

VII-3. REMOVING THE TRANSPARANT WINDOW

- Remove the textplate (see sub. 2)
- Remove the two screws 2 (Fig. 17, page 17)
- Loosen the two screws 3 (Fig. 15, page 16) do not remove them!!
- Lift the transparant window of the chassis

VII-4. REMOVING THE MEASURING SYSTEM ME1

- Remove the transparant window (see sub. 3)
- Remove the two screws 4 (Fig. 17, page 17)
- Lift the measuring system of the chassis

Note: The measuring system is soldered by means of wires to the printed wiring board U1.

VII-5. REMOVING THE POLARITY INDICATOR ME2

- Remove the measuring system ME1
- The polarity indicator ME2 is now accessible

VII-6. REMOVING PRINTED WIRING BOARD U1

- Remove the housing (see sub. 1)
- Remove the two nuts (Fig. 16, page 17)
- Lift the amplifier unit U1/A (Fig. 16, page 17) of the chassis
- Remove the two screws 6 (Fig. 16, page 17)
- Lift the switching unit U1/B of the chassis.

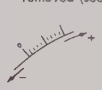
Note: The resistors R1 and R2 and capacitors C1 and C2 (Fig. 13, page 16) are connected directly to the switching unit U1/B.

VIII. Checking and adjusting

VIII-1. ADJUSTING PROCEDURE

The tolerances stated in this chapter correspond to the factory data, which only apply for a complete readjusted instrument.
The tolerances may deviate from those mentioned in the technical data.
When adjusting the PM 2503 the following rules should be taken into account:
- Adjusting the PM 2503, only reference voltages and measuring equipment with the required accuracy should be applied.
- When individual components such as semiconductors or integrated circuits are replaced, the relevant parts of the circuitry should be completely readjusted.
- When adjustments are made always carry out the calibration- and zerosetting (mechanical - electrical) again.

VII-2. ADJUSTING TABLE

ADJUST NO.	ADJUSTMENT	ADJUSTING ELEMENT	PREPARATIONS	MEASURING POINTS	ADJUSTMENT DATA
1.	Battery check	—	Depress: Push button "BATT"	Visible on measuring system ME1	The meter indication should be in BATT region (lower scale). The upper scale indicates the average battery voltage. A voltage difference > 3 V between both batteries indicates also that the batteries are empty.
2.	Zero setting (mechanical)	Adjusting screw above range selector knob	Depress: Push button "OFF"	Visible on measuring system ME1	Adjust the pointer to zero
3.a.	Zero setting (electrical) if this adjustment cannot be made, carry out adjustment 3.b.	Potentiometer "0" (R138)	Depress: Push button " ⎓ " : Range selector knob in range 100 mV	Visible on polarityindicator ME2	Adjust the pointer to the middle of the ~ sign.
3.b.	Offset When adjustment 3.a. cannot be made, carry out first this adjustment and then adjustment 3.a. again.	Resistors R139 and R156	Depress: Push button " ⎓ " : Range selector knob in range 100 mV	Visible on measuring system ME1	The pointer must be in its zero position. When there is a positive deflection opposite to zero, resistor R139 (5.6 should be removed. When there is a negative deflection opposite to zero, resistor R156 (27 k) should be removed (see fig.)  Note: In the -/01 version, resistor R156 already is removed.
4.	1.2 Volt	Potentiometer R131	Depress: Push button " ⎓ " : Range selector knob in range 1 V Supply : 50 mV ⎓ ± 0.1 % to soldering pin 21 (soldering pin 1 = zero)	Soldering pin 5 Soldering pin 1 = zero	1250 mV ± 0.1 % Note: When the adjustment cannot be made, remove resistor R13 and make the adjustment aga
5.	Calibration	Potentiometer "CAL" (R142)	Depress: Push button" ⎓ " : Range selector knob in range 1 V Supply : 50 mV ⎓ ± 0.1 % to soldering pin 21 (soldering pin 1 = zero)	Visible on measuring system ME1	100 scale divisions Note: The calibration procedure mentioned on page 8 of this documentation must b carried only, when no other adjustments are made. (customer adjustment)
6.	1 Volt ⎓ Range	Potentiometer R 127	Depress: Push button" ⎓ " : Range selector knob in range 1 V : Remove the battery cover and connect BU4 to the "V-Ω" socket	Visible on measuring system ME1	100 scale divisions
7.	1 A ⎓ Range	R301 (resistance wire)	Depress: Push button " ⎓ " : Range selector knob in range 1 A Supply : 1 A " ⎓ " ± 0.1 % to the A-input The adjustment can be made by shifting the wire on the wire resistance R301	Visible on measuring system ME1	100 scale divisions
8.a.	30 mA ⎓ Range This adjustment only applies for the /01 and /02 version of the PM 2503	Resistor R158, MR25, 1 % (parallel to R117 up to R120)	Depress: Push button " ⎓ " : Range selector knob in range 30 mA Supply : 30 mA " ⎓ " ± 0.1 % to the input of the PM 2503	Visible on measuring system ME1 Use should be made of a resistance box.	30 scale divisions
8.b.	100 mA ⎓ Range	Resistors R121 and R122	Depress: Push button " ⎓ " : Range selector knob in range 100 mA Supply : 100 mA ⎓ ± 0.1% to the input of the PM 2503	Visible on measuring system ME1 Use should be made of a resistance box.	100 scale divisions
9.	10 V ~ Range	Capacitor C3	Depress: Push button " ~ " : Range selector knob in range 10 V Supply : 10 V ~ ± 0.1 % freq. 10 kHz to the input of the PM 2503	Visible on measuring system ME1	99 scale divisions
10.	100 mV ~ Range	Capacitor C122	Depress: Push button " ~ " : Range selector knob in range 100 mV Supply : 100 mV ~ ± 0.1 % freq. 10 kHz to the input of the PM 2503	Visible on measuring system ME1	100 scale divisions

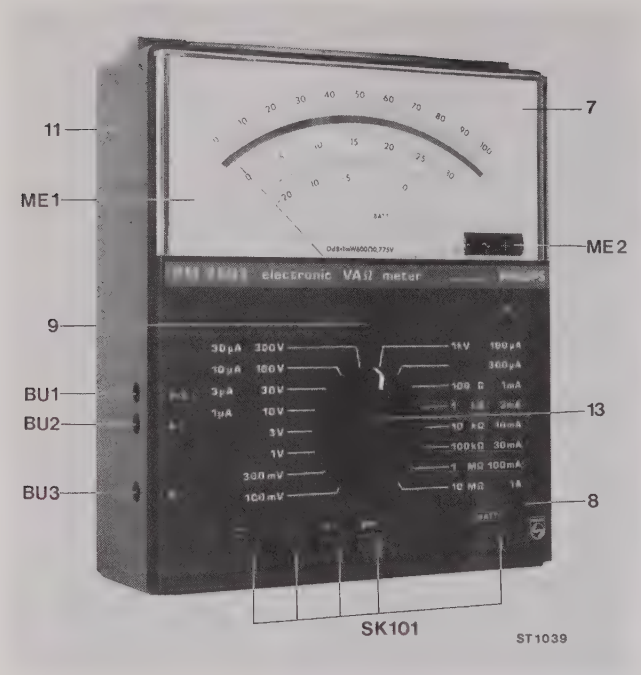


Fig. 11. Front view with item numbers

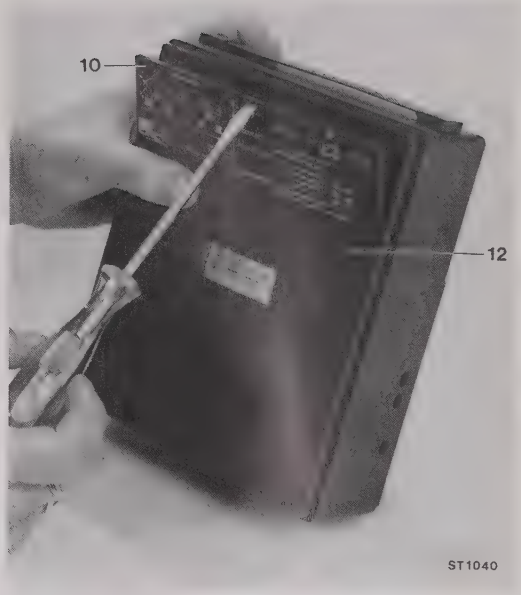


Fig. 12. Rear view

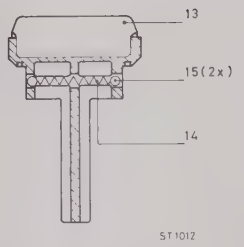


Fig. 14. Range selector knob

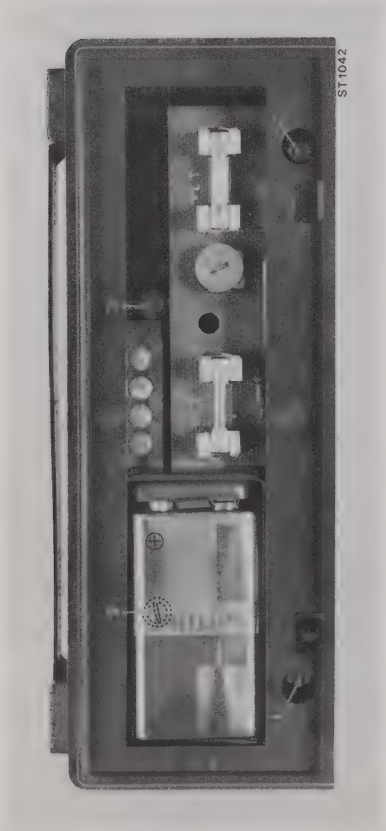


Fig. 15. Removing the transparant window

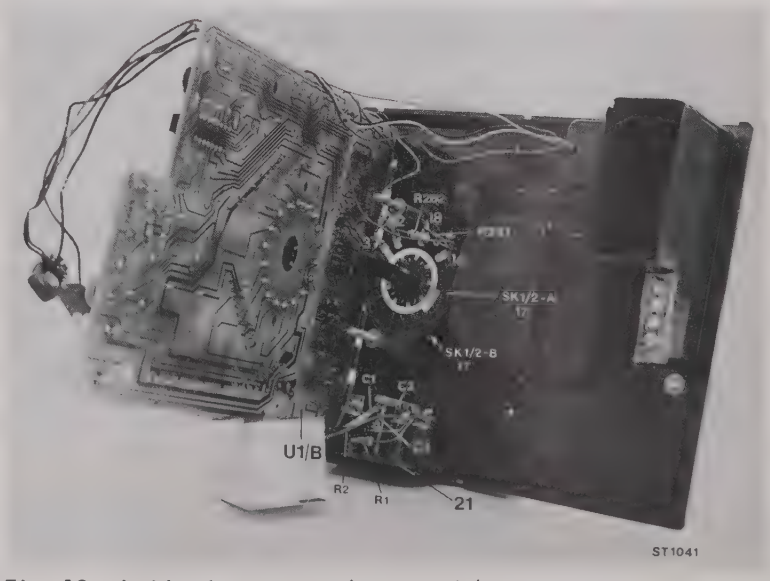


Fig. 13. Inside view range selector SK1/2 and input

IX. List of parts

IX-1. MECHANICAL

Item	Fig.	Qty	Ordering number	Description	
-	1	1	5322 264 24013	Testpin red	
-	1	1	5322 264 24014	Testpin black	
ME1	11	1	5322 344 54002	Measuring system complete	
ME2	11	1	5322 347 10061	Polarity indicator	
7	11	1	5322 447 74003	Transparant window	
8	11	1	5322 456 14032	Textplate	
9	11	1	5322 535 40023	Correction screw	
10	12	1	5322 447 94141	Battery cover	
11	11	1	5322 447 94139	Housing	
12	12	4	5322 462 44148	Foot for housing	
23	17	1	5322 447 94349	Frame	
-	11	1	5322 414 34197	Knob "0"	
-	-	1	5322 535 94795	Potentiometer "0" shaft	
13	11/14	1	5322 414 44039	Range selector knob	SK1
14	14	1	5322 492 54154	Spring range selector knob	SK1
15	14	2	5322 520 40012	Ball-bearing	SK1
16	16	1	5322 273 44052	Segment switch	SK1/1
17	13	1	5322 278 64004	Ohm wafer assy	SK1/2
SK101	11	1	5322 276 54019	Push button switch assy	SK101
18	16	1	5322 492 34397	Spring	SK101
18	16	1	5322 290 34093	Contactstrip	SK101
18	16	1	5322 256 64007	Holder	SK101
19	17	1	5322 414 24911	Push button red	SK101
20	17	4	5322 414 14011	Push button black	SK101
21	13	1	5322 267 44044	Input block with 3 sockets and trimmer C3	
22	16	1	5322 255 44044	IC-socket	IC101

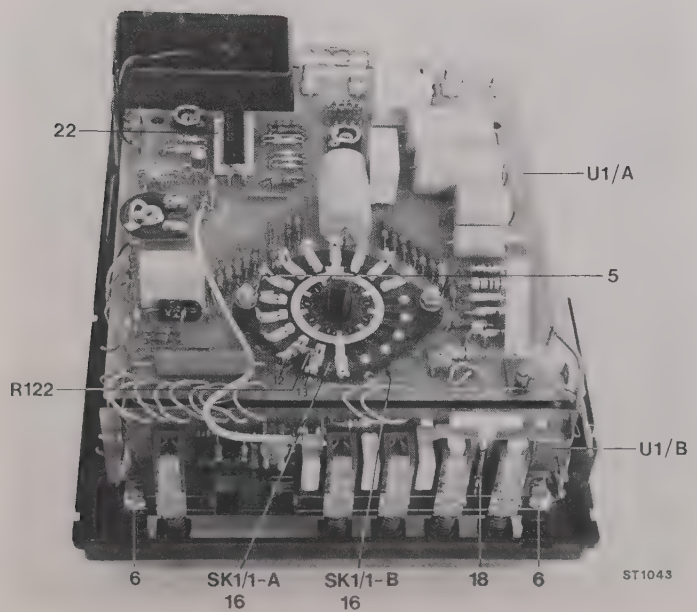


Fig. 16. Inside view range selector SK1/1

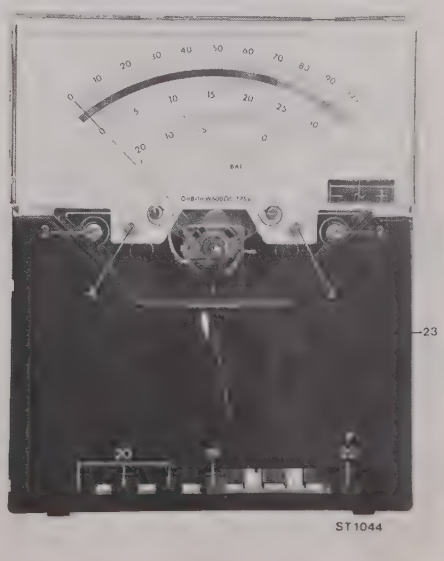


Fig. 17. Front view without textplate

This parts list does not contain multi-purpose and standard parts. These components are indicated in the circuit diagram by means of identification marks. The specification can be derived from the survey below.

Diese Ersatzteilliste enthält keine Universal- und Standard-Teile. Diese sind im jeweiligen Prinzipschaltbild mit Kennzeichnungen versehen. Die Spezifikation kann aus nachstehender Übersicht abgeleitet werden.

In deze stuklijst zijn geen universele en standaardonderdelen opgenomen. Deze componenten zijn in het principeschema met een merkteken aangegeven. De specificatie van deze merktekens is hieronder vermeld.

La présente liste ne contient pas des pièces universelles et standard. Celles-ci ont été repérées dans le schéma de principe. Leurs specifications sont indiquées ci-dessous.

Esta lista de componentes no comprende componentes universales ni standard. Estos componentes están provistos en el esquema de principio de una marca. El significado de estas marcas se indica a continuación.

Carbon resistor E24 series
Kohleschichtwiderstand, Reihe E24
Koolweerstand E24 reeks
Résistance au carbone, série E24
Resistencia de carbón, serie E24

0,125 W 5%

Carbon resistor E12 series
Kohleschichtwiderstand, Reihe E12
Koolweerstand E12 reeks
Résistance au carbone, série E12
Resistencia de carbón, serie E12

1 W ≦ 2,2 MΩ, 5%
> 2,2 MΩ, 10%

Carbon resistor E12 series
Kohleschichtwiderstand, Reihe E12
Koolweerstand E12 reeks
Résistance au carbone, série E12
Resistencia de carbón, serie E12

0,25 W ≦ 1 MΩ, 5%
> 1 MΩ, 10%

Carbon resistor E12 series
Kohleschichtwiderstand, Reihe E12
Koolweerstand E12 reeks
Résistance au carbone, série E12
Resistencia de carbón, serie E12

2 W 5%

Carbon resistor E24 series
Kohleschichtwiderstand, Reihe E24
Koolweerstand E24 reeks
Résistance au carbone, série E24
Resistencia de carbón, serie E24

0,5 W ≦ 5 MΩ, 1%
> 5 ≦ 10 MΩ, 2%
> 10 MΩ, 5%

Wire-wound resistor
Drahtwiderstand
Draadgewonden weerstand
Résistance bobinée
Resistencia bobinada

0,4 – 1,8 W 0,5%

Carbon resistor E12 series
Kohleschichtwiderstand, Reihe E12
Koolweerstand E12 reeks
Résistance au carbone, série E12
Resistencia de carbón, serie E12

0,5 W ≦ 1,5MΩ, 5%
> 1,5MΩ, 10%

Wire-wound resistor
Drahtwiderstand
Draadgewonden weerstand
Résistance bobinée
Resistencia bobinada

5,5 W ≦ 200 Ω, 10%
> 200 Ω, 5%

Wire-wound resistor
Drahtwiderstand
Draadgewonden weerstand
Résistance bobinée
Resistencia bobinada

10 W 5%

Tubular ceramic capacitor
Rohrkondensator
Keramische kondensator, buistype
Condensateur céramique tubulaire
Condensador cerámico tubular

500 V

Polyester capacitor
Polyesterkondensator
Polyesterkondensator
Condensateur au polyester
Condensador polyester

400 V

Tubular ceramic capacitor
Rohrkondensator
Keramische kondensator, buistype
Condensateur céramique tubulaire
Condensador cerámico tubular

700 V

Flat-foil polyester capacitor
Miniatur-Polyesterkondensator (flach)
Platte miniatuur polyesterkondensator
Condensateur au polyester, type plat
Condensador polyester, tipo de placas planas

250 V

Ceramic capacitor, "pin-up"
Keramikkondensator "Pin-up" (Perltyp)
Keramische kondensator "Pin-up" type
Condensateur céramique, type perle
Condensador cerámico, versión "colgable"

500 V

Paper capacitor
Papierkondensator
Papierkondensator
Condensateur au papier
Condensador de papel

1000 V

"Microplate" ceramic capacitor
Miniatur-Scheibenkondensator
"Microplate" keramische kondensator
Condensateur céramique "microplate"
Condensador cerámico "microplaca"

30 V

Wire-wound trimmer
Drahttrimmer
Draadgewonden trimmer
Trimmer à fil
Trimmer bobinado

Mica capacitor
Glimmerkondensator
Micakondensator
Condensateur au mica
Condensador de mica

500 V

Tubular ceramic trimmer
Rohrtrimmer
Buisvormige keramische trimmer
Trimmer céramique tubulaire
Trimmer cerámico tubular

For multi-purpose and standard parts, please see PHILIPS' Service Catalogue.
Für die Universal- und Standard-Teile siehe den PHILIPS Service-Katalog.
Voor universele en standaardonderdelen raadplege men de PHILIPS Service Catalogus.
Pour les pièces universelles et standard veuillez consulter le Catalogue Service PHILIPS.
Para piezas universales y standard consulte el Catálogo de Servicio PHILIPS.

IX-2. ELECTRICAL

IX-2.1. Resistors

Item	Value (Ω)	Tol %	Series	Ordering number	Version
R1	240	5	WR0617E	5322 112 20091	-
R2	10 M	5	VR37	5322 116 64002	-
R101	10 M	5	VR37	5322 116 64002	-
R102	1.8 M	5	VR37	5322 116 60041	-
R103	78.7 k	1	MR25	5322 116 50533	-
R104	511 k	1	MR30	5322 116 54123	-
R107	158 k	1	MR25	5322 116 54715	-
R108	49.9 k	1	MR25	5322 116 50674	-
R109	15.8 k	1	MR25	5322 116 54633	-
R110	4.99 k	1	MR25	5322 116 50523	-
R111	1.58 k	1	MR25	5322 116 50622	-
R112	499	1	MR25	5322 116 54524	-
R113	158	1	MR25	5322 116 54487	-
R114	49.9	1	MR25	5322 116 54441	-
R115	15.8	1	MR25	5322 116 50861	-
R116	4.99	1	MR25	5322 116 50568	-
R117	6.34	1	MR25	5322 116 50862	-/01
R117	6.34	1	MR25	5322 116 50862	-/02
R117	5.36	1	MR25	5322 116 54239	-/03
R118	6.34	1	MR25	5322 116 50862	-/01
R118	6.34	1	MR25	5322 116 50862	-/02
R118	5.36	1	MR25	5322 116 54239	-/03
R119	6.34	1	MR25	5322 116 50862	-/01
R119	6.34	1	MR25	5322 116 50862	-/02
R119	5.36	1	MR25	5322 116 54239	-/03
R120	6.34	1	MR25	5322 116 50862	-/01
R120	6.34	1	MR25	5322 116 50862	-/02
R120	5.36	1	MR25	5322 116 54239	-/03
R121	0.47	10	2 W	5322 113 60022	-
R124	22.6 k	1	MR25	5322 116 50481	-
R125	2.15 k	1	MR25	5322 116 50676	-/01
R125	953	1	MR25	5322 116 54547	-/02
R125	953	1	MR25	5322 116 54547	-/03
R126	1 M	1	MR30	5322 116 54188	-
R127	47 k	20	0.1 W potm.	4822 100 10079	-/01
R127	47 k	20	0.1 W potm.	4822 100 10079	-/02
R127	100 k	20	0.1 W potm.	4822 100 10052	-/03
R128	226 k	1	MR25	5322 116 54729	-/01
R128	205 k	1	MR25	5322 116 54727	-/02
R128	205 k	1	MR25	5322 116 54727	-/03

Item	Value (Ω)	Tol %	Series	Ordering number	Version
R131	1 M	20	0.1 W potm.	4822 100 10089	-
R137	220	1	MR25	5322 116 54002	-
R138	1 k	20	0.1 W potm.	4822 101 10018	-
R139	15 k	1	MR25	5322 116 54001	-
R140	487	1	MR25	5322 116 50508	-/01
R140	442	1	MR25	5322 116 50592	-/02
R140	1.1 k	1	MR25	5322 116 54554	-/03
R141	681	1	MR25	5322 116 54534	-/01
R141	681	1	MR25	5322 116 54534	-/02
R141	16.2	1	MR25	5322 116 54431	-/03
R142	1 k	20	0.1 W potm.	5322 101 14057	-/01
R142	2.2 k	20	0.1 W potm.	5322 101 14024	-/02
R142	4.7 k	20	0.1 W potm.	5322 101 14108	-/03
R143	9.76 k	1	MR25	5322 116 54618	-/01
R143	19.1 k	1	MR25	5322 116 54639	-/02
R143	19.1 k	1	MR25	5322 116 54639	-/03
R145	30.1 k	1	MR25	5322 116 54655	-
R146	2.74 k	1	MR25	5322 116 54738	-
R147	33.2 k	1	MR25	5322 116 50482	-
R148	42.2 k	1	MR25	5322 116 50474	-
R149	42.2 k	1	MR25	5322 116 50474	-
R150	33.2 k	1	MR25	5322 116 50482	-
R153	196 k	1	MR25	5322 116 54725	-
R154	154 k	1	MR25	5322 116 54725	-/01
R154	154 k	1	MR25	5322 116 54714	-/02
R154	154 k	1	MR25	5322 116 54714	-/03
R158	Adjusting resistor				-/01
R158	Adjusting resistor				-/02
R158	5.36	1	MR25	5322 116 54239	-/03
R159	-	-	-	-	-/01
R159	1 M	1	MR25	5322 116 54188	-/02
R159	1 M	1	MR25	5322 116 54188	-/03
R160	-	-	-	-	-/01
R160	1.24 k	1	MR25	5322 116 54559	-/02
R160	1.24 k	1	MR25	5322 116 54559	-/03
R164	-	-	-	-	-/01
R164	-	-	-	-	-/02
R164	133 k	1	MR25	5322 116 54708	-/03
R165	-	-	-	-	-/01
R165	-	-	-	-	-/02
R165	3.83 k	1	MR25	5322 116 54583	-/03
R201	237 k	1	MR25	5322 116 54732	-/01
R201	237 k	1	MR25	5322 116 54732	-/02
R201	118 k	1	MR25	5322 116 54703	-/03
R202	24 M	5	VR37	5322 116 64003	-/01
R202	24 M	5	VR37	5322 116 64003	-/02
R202	12 M	5	VR37	4822 110 42216	-/03

IX-2.2. Capacitors

Item	Value (F)	Tol (%)	Voltage (V)	Ordering number	Description	Version
C3	6 p	1	400	5322 125 60069	Trimmer	-
C101	215 p	1	500	5322 121 54075	Polystyrene	-
C102	887 p	1	125	5322 121 50484	Polystyrene	-
C103	3.01 n	1	63	5322 121 50483	Polystyrene	-
C104	0.01 µ	1	63	4822 121 50097	Polystyrene	-
C105	0.0316 µ	1	63	5322 121 50486	Polystyrene	-
C106	0.1 µ	1	63	5322 121 50425	Polystyrene	-
C107	0.158 µ	1	63	5322 121 50485	Polystyrene	-
C108	0.158 µ	1	63	5322 121 50485	Polystyrene	-
C109	1 µ	10	100	5322 121 40197	Polyester	-
C110	1 µ	10	100	5322 121 40197	Polyester	-
C111	1 µ	10	100	5322 121 40197	Polyester	
C112	0.015 µ	10	250	4822 121 41138	Polyester	-
C113	0.015 µ	10	250	4822 121 41138	Polyester	-
C114	0.01 µ	10	630	4822 121 41134	Polyester	-
C115	100 p	10	500	4822 122 31211	Ceramic	-
C116	22 n	-20/+80	63	4822 122 30103	Ceramic	-
C117	22 n	-20/+80	63	4822 122 30103	Ceramic	-
C118	1.5 n	10	100	4822 122 31221	Ceramic	-/01
C118	470 p	10	100	4822 122 31177	Ceramic	-/02
C118	470 p	10	100	4822 122 31177	Ceramic	-/03
C119	560 p	10	100	4822 122 31166	Ceramic	-
C120	330 p	10	100	4822 122 31165	Ceramic	-
C121	330 p	10	100	4822 122 31165	Ceramic	-
C122	22 p		100	4822 125 50045	Trimmer	-
C123	6.8 µ		10	4822 124 20458	Electrolytic	-
C124	6.8 µ		10	4822 124 20458	Electrolytic	-
C125	150 p	10	500	4822 122 31219	Ceramic	-
C126	120 p	2	100	4822 122 30093	Ceramic	-/01
C126	68 p	2	100	4822 122 31076	Ceramic	-/02
C126	68 p	2	100	4822 122 31076	Ceramic	-/03

IX-2.3. Diodes

Item	Description	Ordering number	Version
GR101	BAW62	5322 130 30613	-
GR102	BAW62	5322 130 30613	-/01
GR102	-	-	-/02
GR102	-	-	-/03
GR103	BAW62	5322 130 30613	-
GR104	BAW62	5322 130 30613	-
GR105	BAW62	5322 130 30613	-
GR106	BZX70 / C10	5322 130 34299	-

IX-2.4. Transistors

Item	Description	Ordering number	Version
TS101	BC547	4822 130 40965	-
TS102	BC557	4822 130 40973	-
TS103	ON528	5322 130 44405	-
TS104	-	-	-/01
TS104	BC547	5322 130 40965	-/02
TS104	BC547	5322 130 40965	-/03

IX-2.5. Integrated circuits

Item	Description	Ordering number
IC101	OQ-051	5322 209 84444

IX-3. MISCELLANEOUS

Item	Fig.	Qty.	Ordering number	Description
U1A/B	16	1	5322 216 74042	Printed wiring board U1 without IC101, fuses VL1 and VL2 and shunt R301
VL1	15	1	4822 253 20023	Fuse VL1 2A S.B.
VL2	15	1	4822 253 20007	Fuse VL2 125 mA S.B.

QUALITY REPORTING

CODING SYSTEM FOR FAILURE DESCRIPTION

The following information is meant for Philips service workshops only and serves as a guide for exact reporting of service repairs and maintenance routines on the workshop charts.
For full details reference is made to Information G1 (Introduction) and Information Cd 689 (Specific information for Test and Measuring Instruments).

LOCATION

□□□

Unit number
e.g. 000A or 0001 (for unit A or 1; **not 00UA or 00U1)**

or: Type number of an accessory (only if delivered with the equipment)
e.g. 9051 or 9532 (for PM 9051 or PM 9532)

or: Unknown/Not applicable
0000

CATEGORY

□

0 Unknown, not applicable (fault not present, intermittent or disappeared)
1 Software error
2 Readjustment
3 Electrical repair (wiring, solder joint, etc.)
4 Mechanical repair (polishing, filing, remachining, etc.)
5 Replacement
6 Cleaning and/or lubrication
7 Operator error
8 Missing items (on pre-sale test)
9 Environmental requirements are not met

COMPONENT/SEQUENCE NUMBER

□□□□□

Enter the identification **as used in the circuit diagram,** e.g.:

GR1003	Diode GR1003
TS0023	Transistor TS23
IC0101	Integrated circuit IC101
R0....	Resistor, potentiometer
C0....	Capacitor, variable capacitor
B0....	Tube, valve
LA....	Lamp
VL....	Fuse
SK....	Switch
BU....	Connector, socket, terminal
T0....	Transformer
L0....	Coil
X0....	Crystal
CB....	Circuit block
RE....	Relay
BA....	Battery
TR....	Chopper

Parts not identified in the circuit diagram:

990000	Unknown/Not applicable
990001	Cabinet or rack (text plate, emblem, grip, rail, graticule, etc.)
990002	Knob (incl. dial knob, cap, etc.)
990003	Probe (only if attached to instrument)
990004	Leads and associated plugs
990005	Holder (valve, transistor, fuse, board, etc.)
990006	Complete unit (p.w. board, h.t. unit, etc.)
990007	Accessory (only those without type number)
990008	Documentation (manual, supplement, etc.)
990009	Foreign object
990099	Miscellaneous

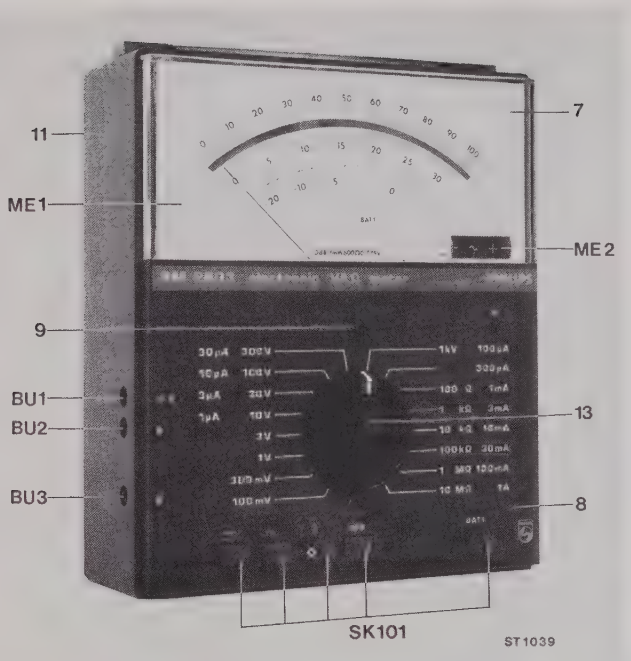


Fig. 11. Front view with item numbers

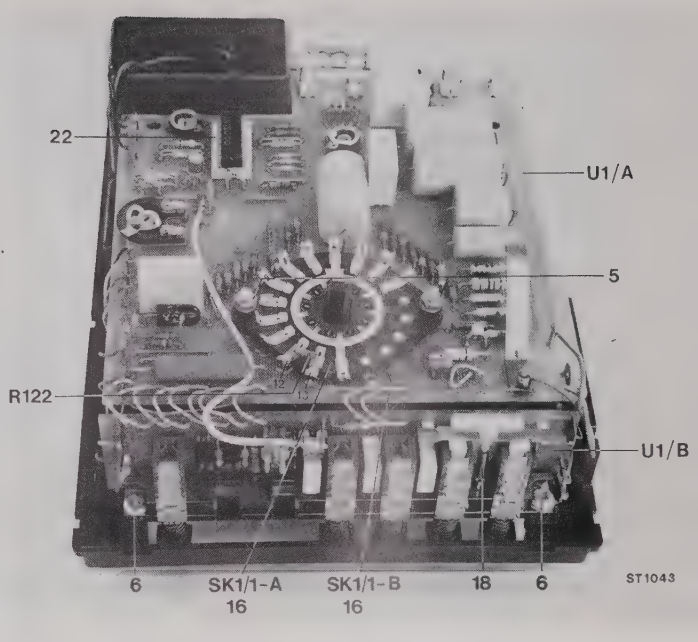


Fig. 16. Inside view range selector SK1/1

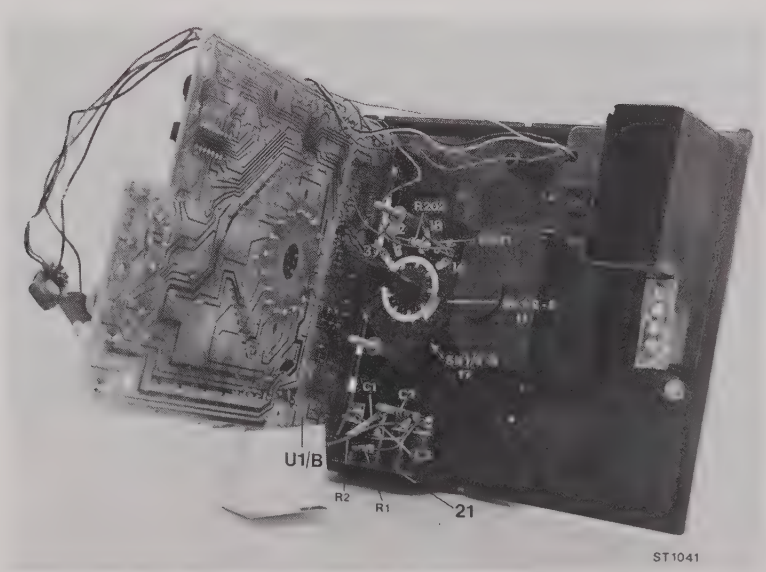


Fig. 13. Inside view range selector SK1/2 and input

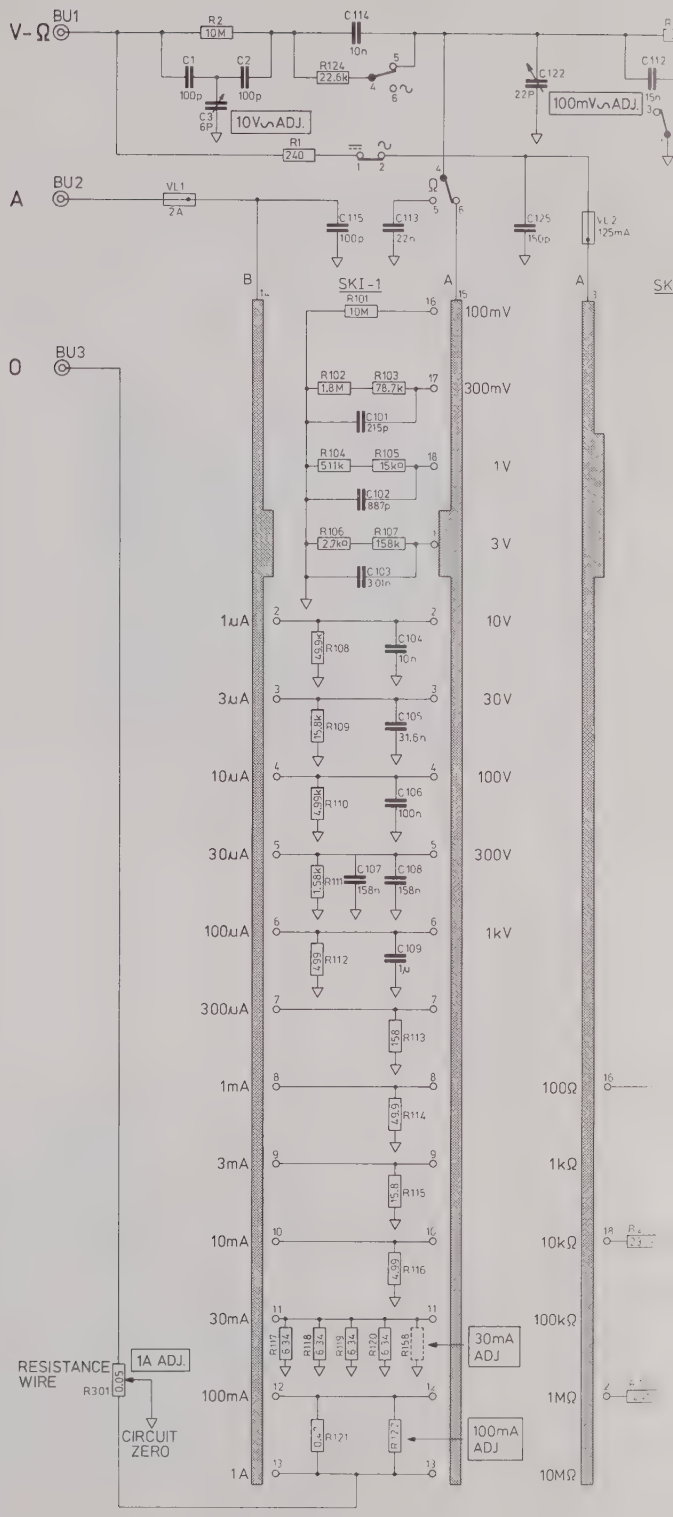
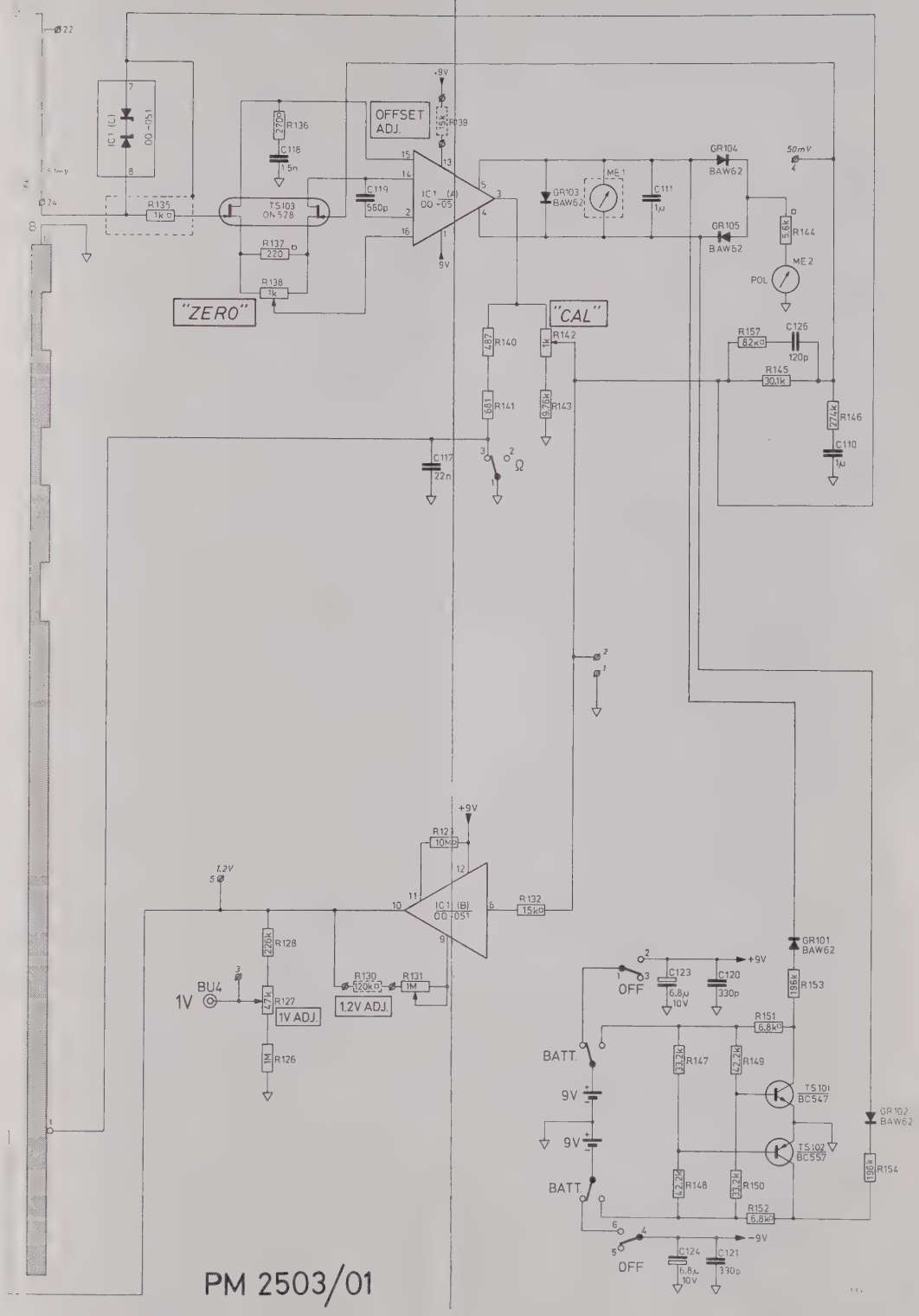


Fig. 18. Circuit diagram

Version	R117/R120	R125	R127	R128	R136	R144	R140
-/01	6.34 Ω	2.15 k	47 k	226 k	270 Ω	5.6 k	487 Ω
-/02	6.34 Ω	953 Ω	47 k	205 k	330 Ω	8.2 k	442 Ω
-/03	5.36 Ω	953 Ω	100 k	205 k	330 Ω	8.2 k	1.1 k

Note: 1. In the -/02 and -/03 version resistor R153 and diode GR101 are excl
2. In the -/02 and -/03 version diode GR102 is changed into a transisto
3. In the -/03 version the 30 mA adjustment with R158 is cancelled. Resistor R158 is fixed.



SURVEY OF MODIFICATIONS -/01, -/02 AND -/03 VERSION

	COMPONENTS																		
R143	R137	R153	R154	R156	R158	R159	R160	R161	R162	R163	R164	R165	R201	R202	C118	C126	GR102	TS104
7.76 k	220 Ω	196 k	196 k	-	Adj.	-	-	-	-	-	-	-	237 k	24 M	1.5 nF	120 pF	BAW62	-
17.1 k	68 Ω	187 k	154 k	270 k	Adj.	1 M	1.24 k	-	-	-	-	-	118 k	12 M	470 pF	68 pF	-	BC547
19.1 k	68 Ω	187 k	154 k	270 k	5.36 Ω	1 M	1.24 k	100 Ω	10 Ω	1 Ω	133 k	3.83 k	118 k	12 M	470 pF	68 pF	-	BC547

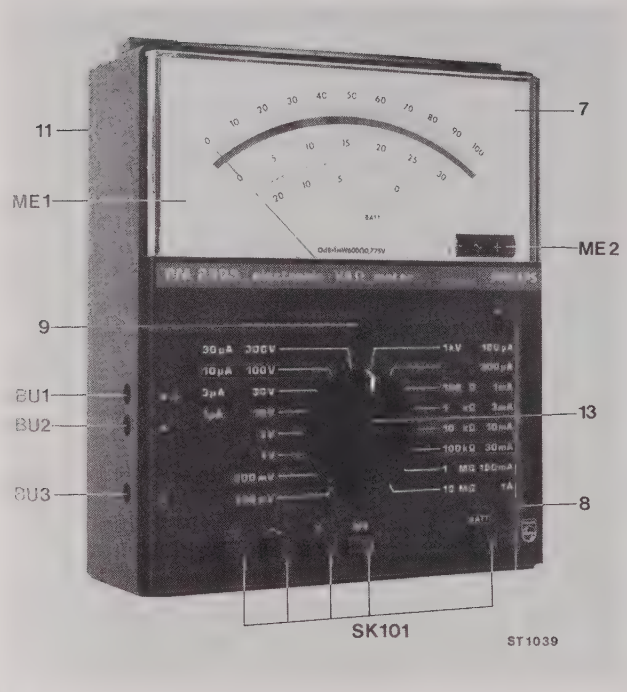


Fig. 11. Front view with item numbers

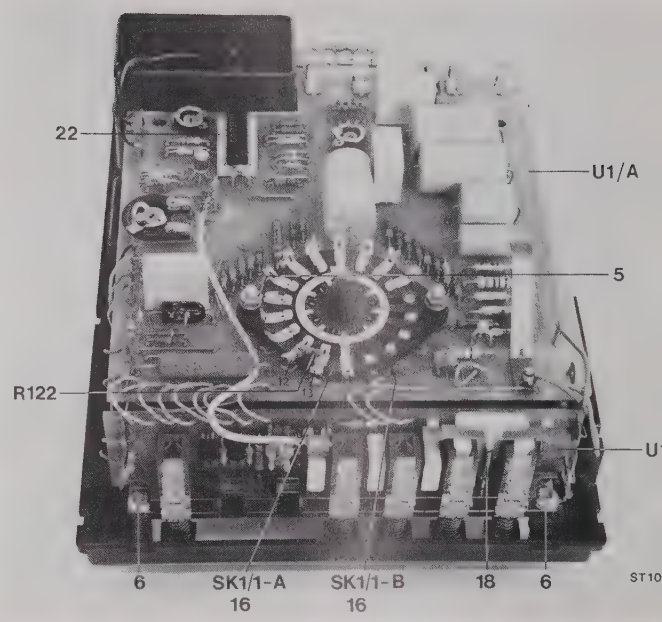


Fig. 16. Inside view range selector SK1/1

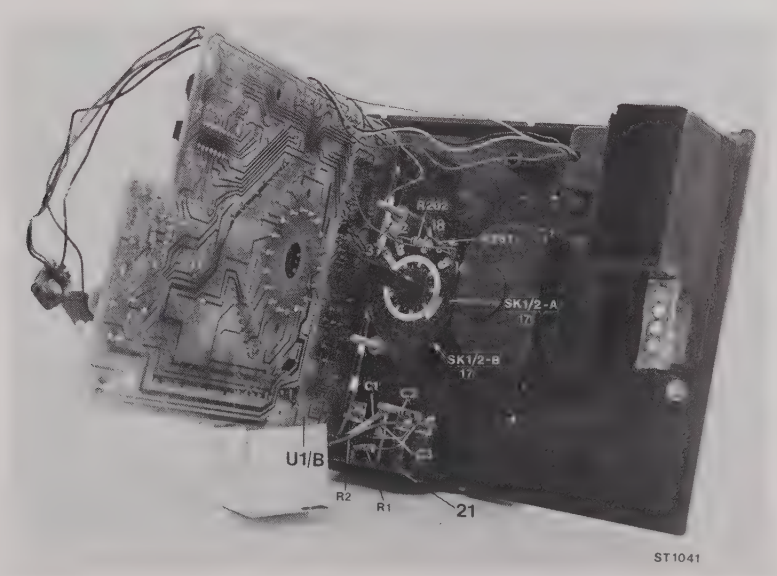


Fig. 13. Inside view range selector SK1/2 and input

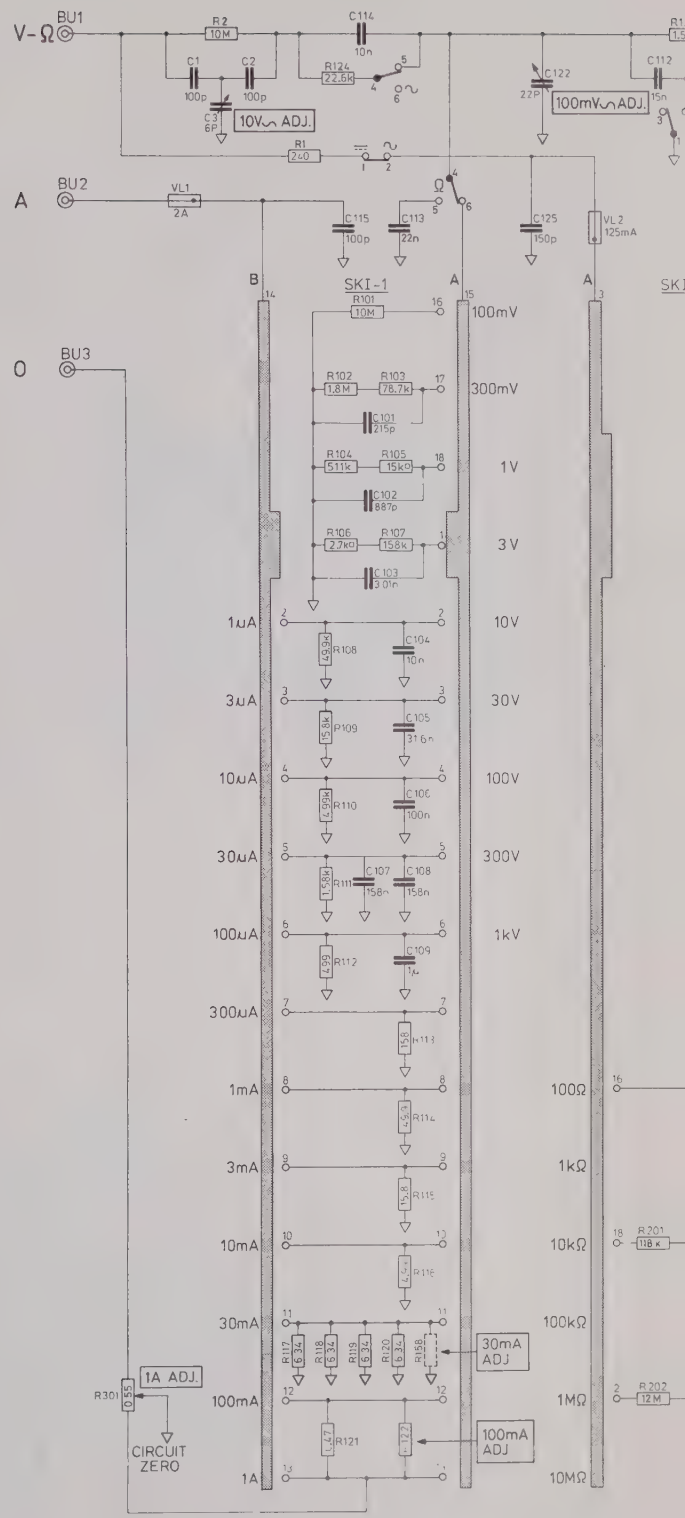
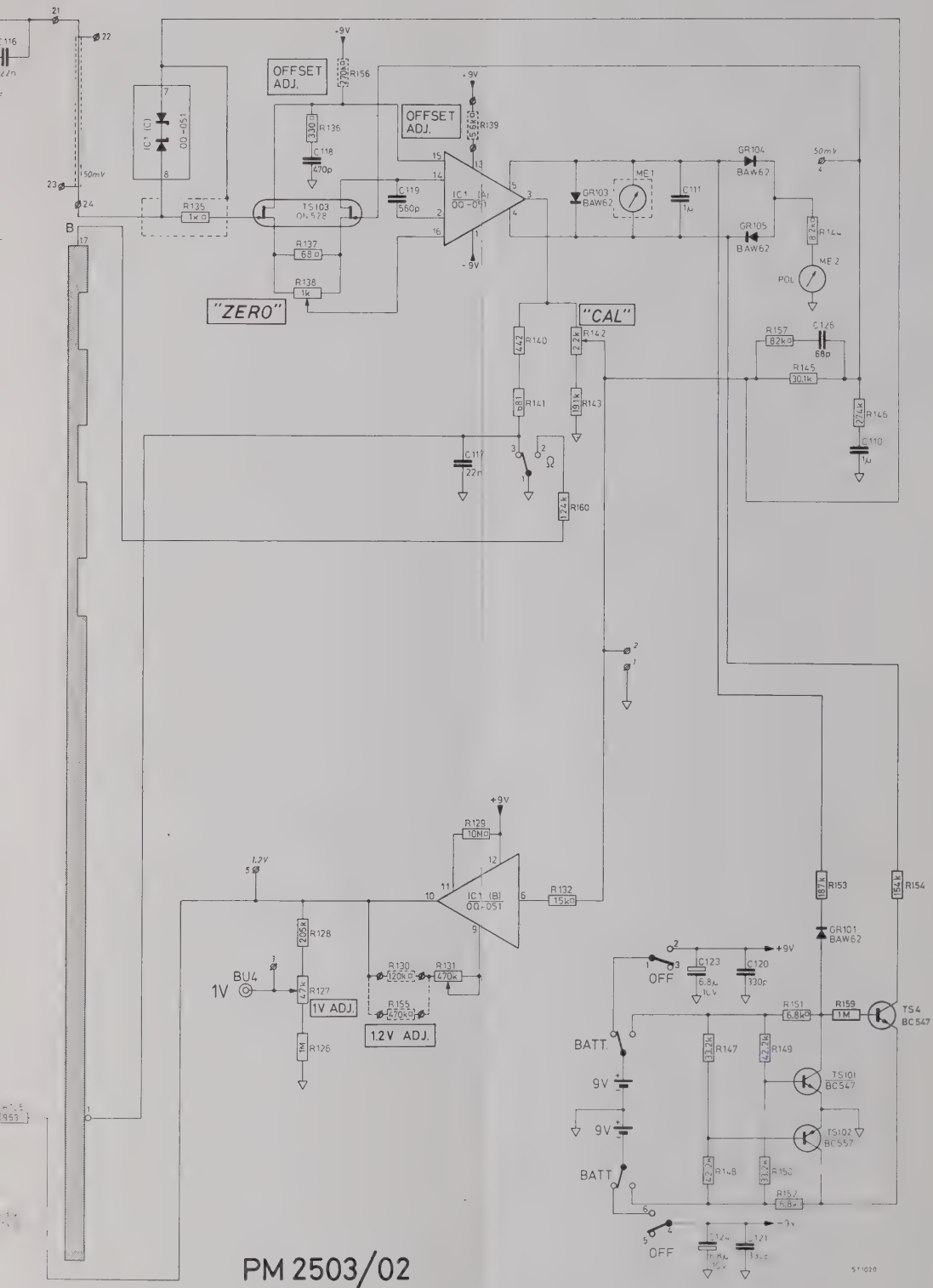


Fig. 18. Circuit diagram

Version	R117/R120	R125	R127	R128	R136	R144	R140	R141
-/01	6.34 Ω	2.15 k	47 k	226 k	270 Ω	5.6 k	487 Ω	681 Ω
-/02	6.34 Ω	953 Ω	47 k	205 k	330 Ω	8.2 k	442 Ω	681 Ω
-/03	5.36 Ω	953 Ω	100 k	205 k	330 Ω	8.2 k	1.1 k	16.2 Ω

Note: 1. In the -/02 and -/03 version resistor R153 and diode GR101 are exch
2. In the -/02 and -/03 version diode GR102 is changed into a transisto
3. In the -/03 version the 30 mA adjustment with R158 is cancelled. Resistor R158 is fixed.



SURVEY OF MODIFICATIONS -/01, -/02 AND -/03 VERSION

	COMPONENTS																			
42	R143	R137	R153	R154	R156	R158	R159	R160	R161	R162	R163	R164	R165	R201	R202	C118	C126	GR102	TS104
1 k	9.76 k	220 Ω	196 k	196 k	-	Adj.	-	-	-	-	-	-	-	237 k	24 M	1.5 nF	120 pF	BAW62	-
2 k	19.1 k	68 Ω	187 k	154 k	270 k	Adj.	1 M	1.24 k	-	-	-	-	-	118 k	12 M	470 pF	68 pF	-	BC547
2 k	19.1 k	68 Ω	187 k	154 k	270 k	5.36 Ω	1 M	1.24 k	100 Ω	10 Ω	1 Ω	133 k	3.83 k	118 k	12 M	470 pF	68 pF	-	BC547

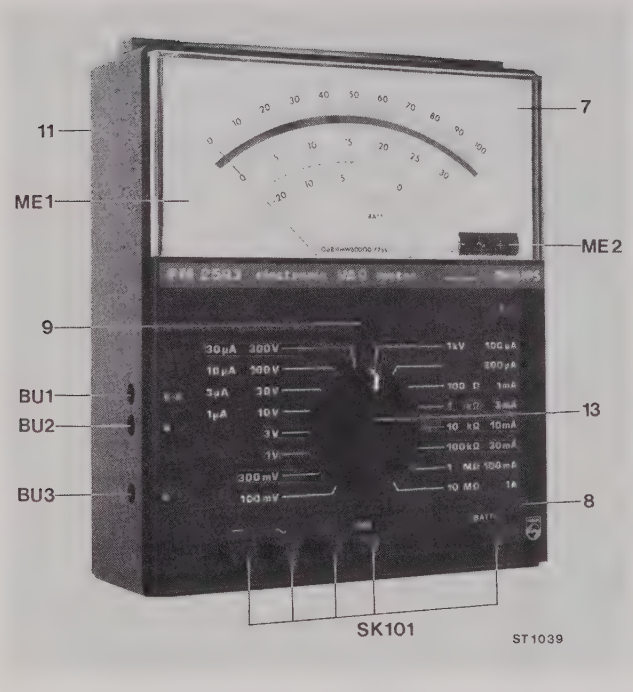


Fig. 11. Front view with item numbers

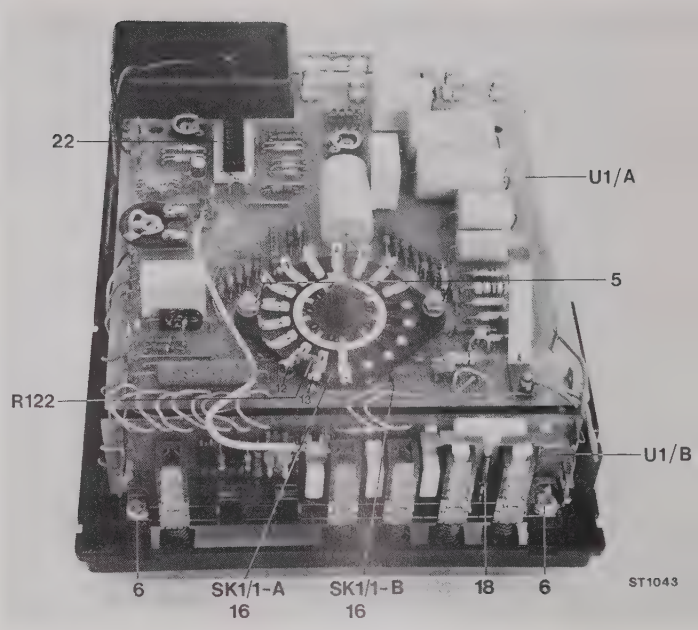


Fig. 16. Inside view range selector SK1/1

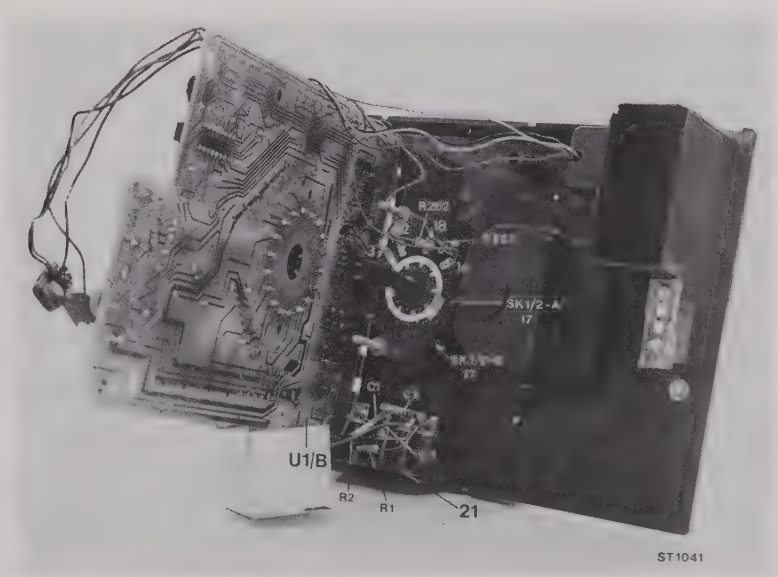


Fig. 13. Inside view range selector SK1/2 and input

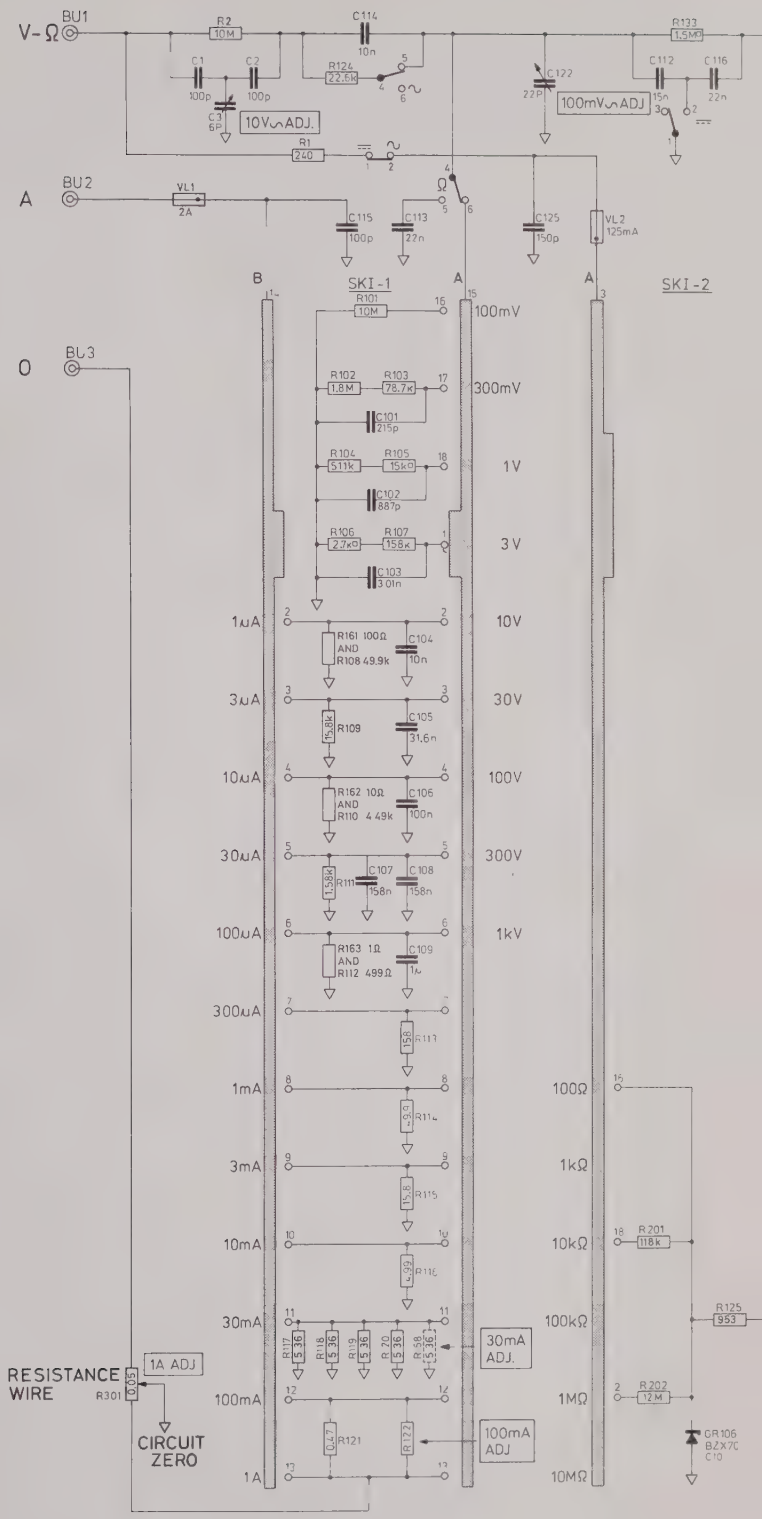
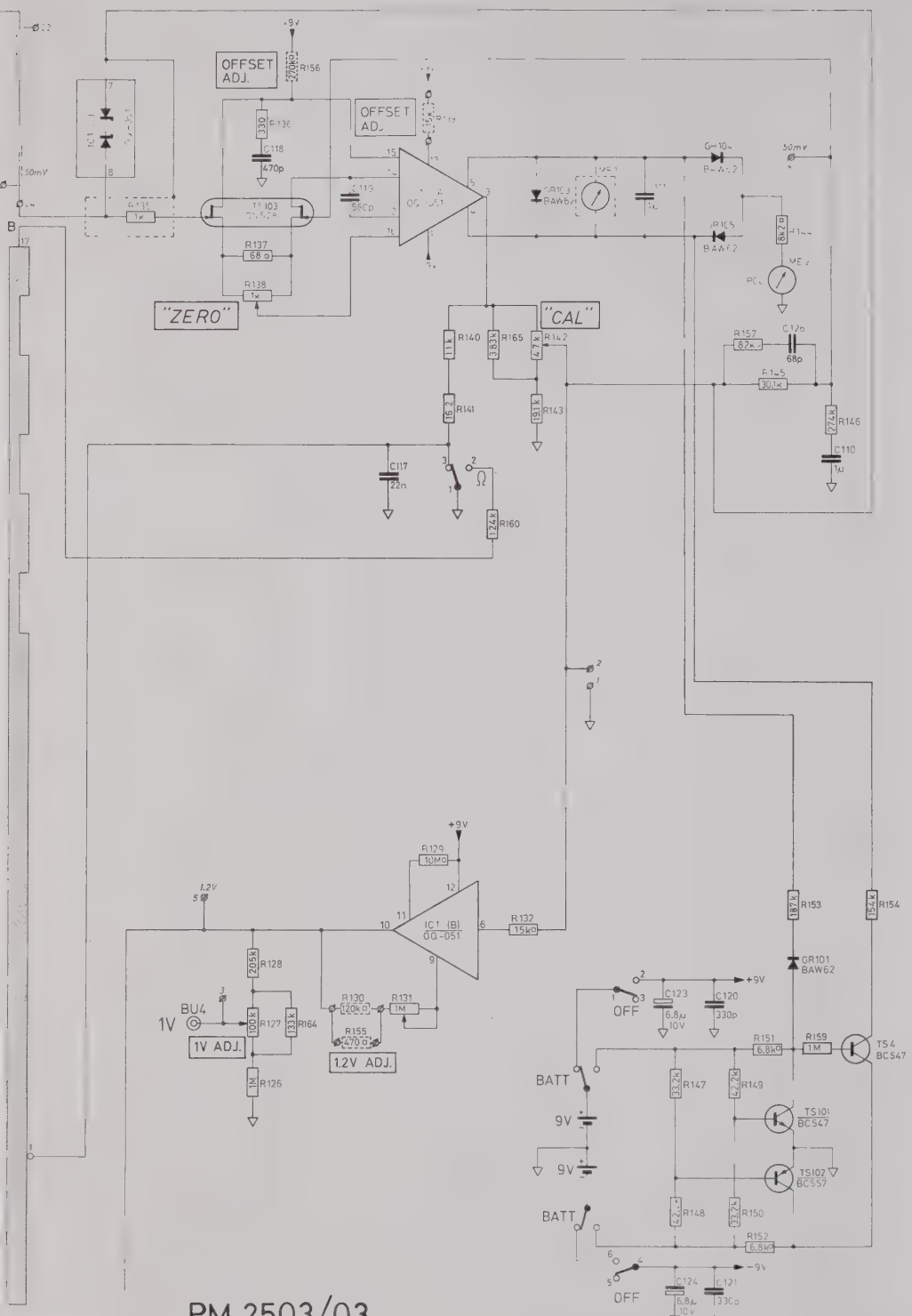


Fig. 18. Circuit diagram

Version	R117/R120	R125	R127	R128	R136	R144	R140	R141	R142	R
-/01	6.34 Ω	2.15 k	47 k	226 k	270 Ω	5.6 k	487 Ω	681 Ω	1 k	9.
-/02	6.34 Ω	953 Ω	47 k	205 k	330 Ω	8.2 k	442 Ω	681 Ω	2.2 k	19
-/03	5.36 Ω	953 Ω	100 k	205 k	330 Ω	8.2 k	1.1 k	16.2 Ω	4.7 k	19

Note: 1. In the -/02 and -/03 version resistor R153 and diode GR101 are exchanged.
2. In the -/02 and -/03 version diode GR102 is changed into a transistor TS104.
3. In the -/03 version the 30 mA adjustment with R158 is cancelled. Resistor R158 is fixed.



PM 2503/03

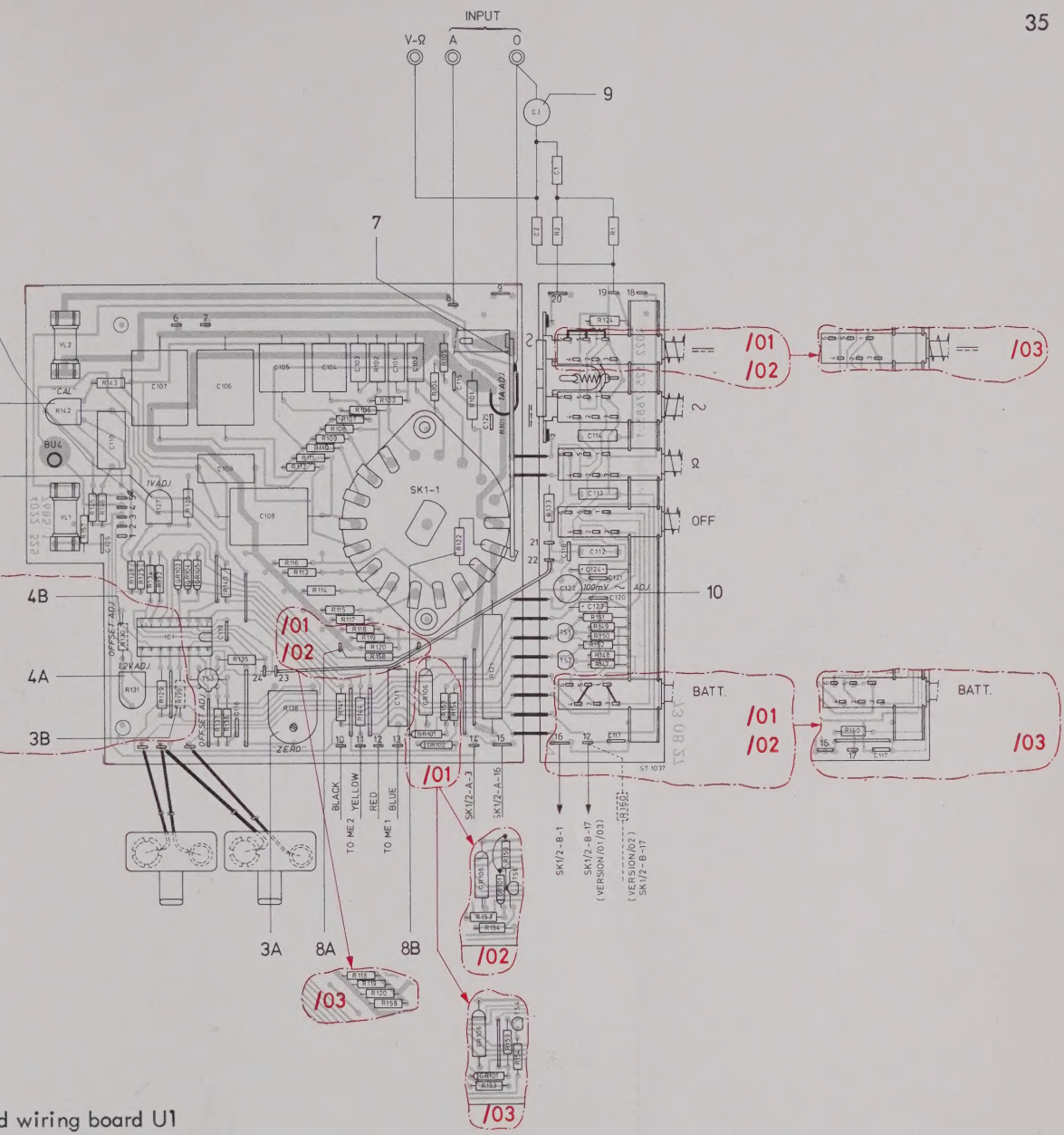
/02
/03

Fig

SURVEY OF MODIFICATIONS -/01, -/02 AND -/03 VERSION

COMPONENTS

R137	R153	R154	R156	R158	R159	R160	R161	R162	R163	R164	R165	R201	R202	C118	C126	GR102	TS104
220 Ω	196 k	196 k	-	Adj.	-	-	-	-	-	-	-	237 k	24 M	1.5 nF	120 pF	BAW62	-
68 Ω	187 k	154 k	270 k	Adj.	1 M	1.24 k	-	-	-	-	-	118 k	12 M	470 pF	68 pF	-	BC547
68 Ω	187 k	154 k	270 k	5.36 Ω	1 M	1.24 k	100 Ω	10 Ω	1 Ω	133 k	3.83 k	118 k	12 M	470 pF	68 pF	-	BC547



d wiring board U1

RANGE							
	A ⎓	A ∿	Ω	⏚	BATT	OFF
	1µA/1A	1µA/1A	100Ω/10MΩ	1kΩ		

CLOSED
OPEN
CLOSED OR OPEN (not important)

ST 1035

RANGE SELECTOR SWITCH SK 1

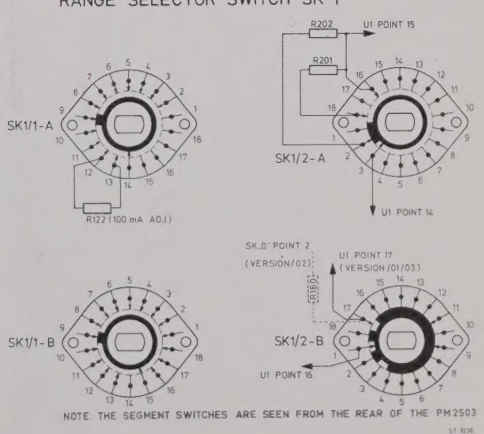


Fig. 20. Range selector switch SK2

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